Computer manufacturing: change and competition

A historical study of the computer industry reveals that computer manufacturers add workers to their payrolls then shed them when the products they manufacture undergo technological change, increased demand, and international competition; what is the impact on workers in the industry?

Jacqueline Warnke

Technological breakthroughs in the computer industry have been dramatic. For example, musical birthday cards have more computing power than existed anywhere in the world, prior to 1950.[1] In addition, computing power that once cost millions of dollars can now be had for hundreds. Gordon Moore, chairman of Intel, has stated: "If the auto industry had moved at the same speed as our industry, your car today would cruise comfortably at a million miles an hour and probably get a half a million miles per gallon of gasoline. But it would be cheaper to throw your Rolls Royce away than to park it downtown for an evening."[2]

The effects of technology on the cost and speed of computers have been as dramatic as its effects on employment in the computer industry. After the introduction of the world's first personal computer in 1975, the industry enjoyed many years of phenomenal employment growth. Between 1960 and 1984, employment in the manufacturing of computers and computer equipment rose by 259 percent,[3] compared with a 74-percent increase in total nonfarm payroll employment. However, from 1984 to 1995, the computer manufacturing industry began to change, losing 32 percent of its work force. This is one of the swiftest declines in all manufacturing industries during this period. (See chart 1.) This article discusses some of the reasons behind this decline, which include a shift in focus from computer hardware to software, changing industry dynamics, international competition, and emerging technologies.

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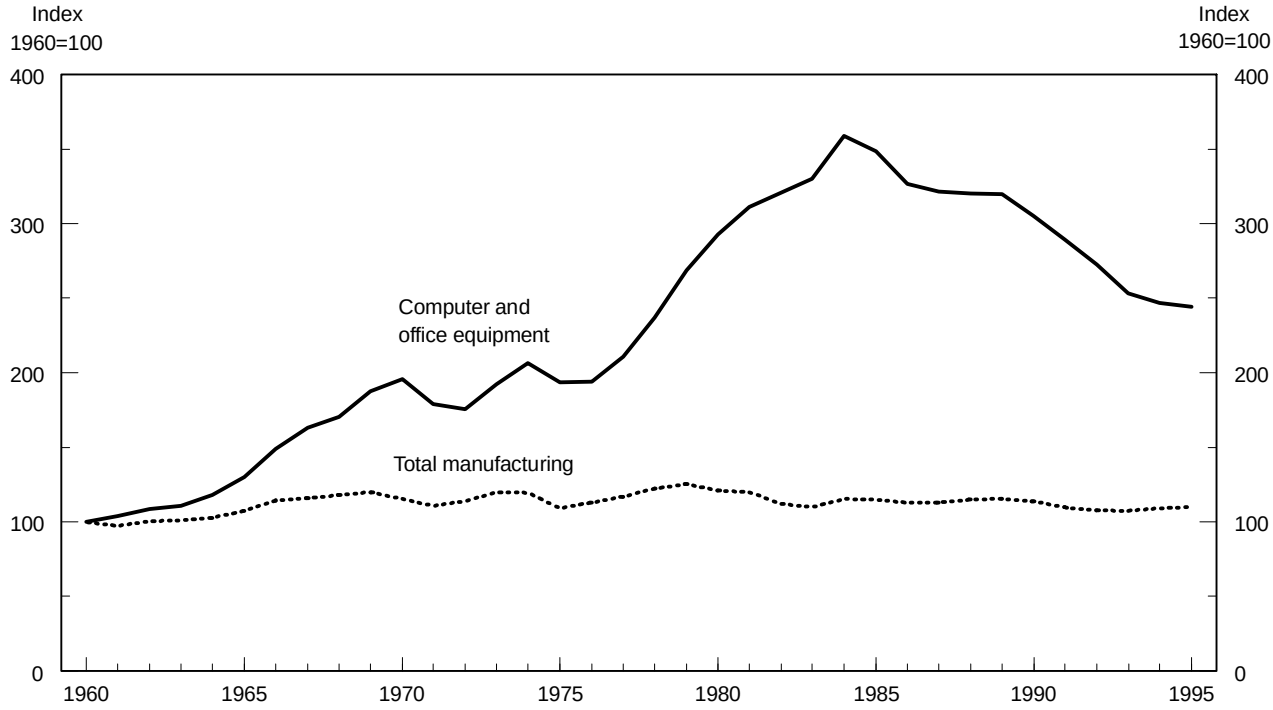
Early computers

Technological innovations that began as early as the 1600's—such as the first mechanical calculating device—have ushered our society into what is now called "the information age."[4] The concept of the computer can be credited to English mathematician Charles Babbage. In 1823, he designed what became the theoretical model for modern computers. His design included devices for entering and storing data, performing calculations, and displaying the results. It was not until 1945 that Presper Eckert and John W. Mauchly invented the first computer—the ENIAC (Electrical Numerical Integrator and Computer). This huge machine measured 30 feet by 50 feet, weighed 30 tons, and contained 18,000 vacuum tubes, 6,000 switches, 1,500 relays, and hundreds of plug wires. It added 5,000 10-digit numbers in one second, a rate 1,000 times faster than any other calculator in existence.[5] Although it was designed to calculate ballistic trajectories, it was used to decide whether or not it was possible to build a hydrogen bomb. It took 6 weeks to compute half a million punch cards to come up with the answer, and the answer was correct! Inventions such as the transistor in 1947 and the mi-

Chart 1. **Indexes of employment in computer and office equipment manufacturing and total manufacturing, 1960–95**



croprocessor in 1971 led to the creation of the world's first personal computer in 1975 by Ed Roberts. Not far behind, the Apple and the IBM versions of the personal computer were introduced. From this time forward, the computer has evolved rapidly, with new technologies not only reducing size and cost, but also increasing memory and processing power tremendously.

Computer manufacturing

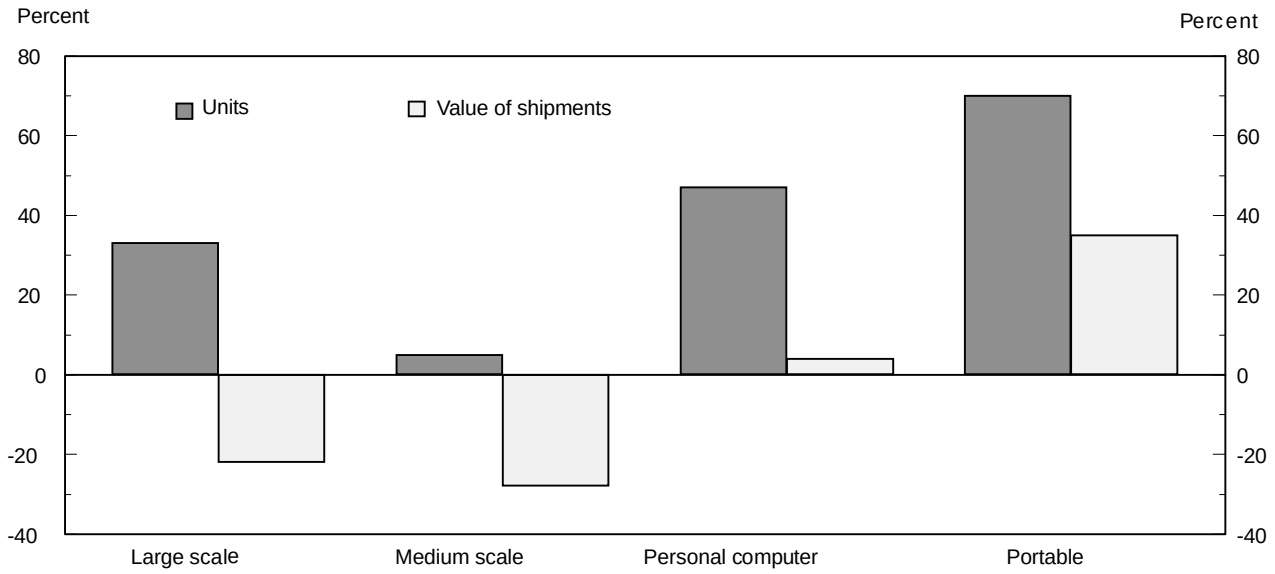
The developments in computer technology prior to 1957 led the Office of Management and Budget to create "computer manufacturing" as an industry classification—SIC 357.[6] This industry is defined as those establishments primarily engaged in the manufacturing of electronic computers, peripherals, and storage devices. In 1994, the industry employed 354,000 people and made up 1.9 percent of all manufacturing employment in 1994. This compares with 4.9 percent employed in motor vehicles and equipment, 2.6 percent in aircraft and parts, and 3.7 percent in textile mill products. Albeit a relatively small section of the economy, this industry had shipments valued at $77 billion in 1993 or 2.5 percent of all manufacturing shipments.[7] The history of the computer is unique, and an understanding of it may clarify recent trends in this industry.

Computer equipment manufacturing is divided into several major categories: electronic computers, peripherals, storage devices, computer terminals, and other office equipment. The largest in both employment and production is electronic computers, with about 57 percent of employment in 1994 and 60 percent of shipments.[8] (See table 1.) The dollar value of shipments in the computer industry increased by 29 percent in 1994, following several years of much smaller growth.

The value of shipments, however, can be misleading when analyzing the health of the industry. A moderate increase in the dollar value of shipments hides the fact that there has been a substantial increase in the number of units shipped. This has occurred because the price of computers has plummeted so rapidly. During the past 20 years, the cost of one particular characteristic of computers, namely processing speed, has dropped approximately 1 million fold, while the number of units produced has skyrocketed.[9] As an example, from 1992 to 1993, the number of personal computer units produced rose by 45 percent, but the value of shipments increased by only 3 percent. (See chart 2.)

Electronic computer manufacturing. Computers can range from supercomputers, costing up to $35 million,[10] to personal computers and laptops, costing less than $500. It is more useful to look at the types of computers separately to understand

Chart 2. **Percent change in units and value of shipments for selected computer types, 1992 to 1993**



SOURCE:: 1993 Annual Survey of Manufactures, U.S. Department of Commerce, Bureau of the Census, MA35R - Computers: Office and Accounting Machines.

the changes in the direction of electronic processing which are taking place in the electronic computer market segment (SIC 3571). The Computer and Business Equipment Manufacturers Association divides computer types into mainframes, minicomputers and microcomputers.[11]

Mainframes were the first commercial computers, and are the largest, most powerful computers available. This category includes supercomputers and massively parallel computers (a new type of computer that consists of hundreds of microprocessors, and whose performance can exceed supercomputers). As table 2 shows, in 1975, this segment of computer manufacturing made up 15 percent of the total units shipped and 76 percent of the value of shipments. Estimates for 1995 show that mainframes will make up only 1 percent of units shipped with the value of the shipments at 29 percent.

Minicomputers are smaller than mainframes, and are traditionally used for business, scientific, and engineering tasks. These computers usually range in cost from $10,000 to $1 million. The lines have blurred in recent years between minicomputers and mainframes, and hybrids such as minisupercomputers exist. Minicomputers boasted a share of the total computer market of 61 percent in 1975, but have dropped to 2 percent in 1995. In terms of value of shipments, minicomputers commanded a 23-percent share in 1975, which has remained little changed 20 years later.

Table 1. **Distribution of employment and shipments in computer manufacturing segments, 1988 and 1994**

SIC	Industry	1988			1994		
		Employment		Shipments	Employment		Shipments
		Percent	Number	Percent	Percent	Number	Percent
357	Computer and office equipment	100	459,100	100	100	351,000	100
3571	Electronic computers	65	297,000	49	57	200,400	60
3572,7	Computer storage devices, peripherals, n.e.c.	20	92,800	39	27	95,500	32
3575,8,9	Computer terminals, calculators, and office machines, n.e.c.	15	68,400	12	16	55,100	8

NOTE: Distribution based on the value of shipments. n.e.c. = not elsewhere classified.

SOURCE: Employment data are from the Current Employment Statistics Program, Bureau of Labor Statistics. Shipments data are from the Bureau of the Census.

Microcomputers, the most dynamic of the three computer types, are the lowest priced and smallest units. They include personal computers (PC's), workstations, and laptops. They are used for individual information needs, business tasks, and entertainment. This segment has undergone extraordinary growth, posting a 7,000-percent increase in the number of units shipped between 1975 and 1980. By 1995, this segment is estimated to make up 97 percent of the total computer market, in terms of units shipped, and 46 percent of the value of shipments.

What sets PC's apart from the other computer types is their affordability, which allows average consumers and small businesses to own them. Rapid advancements in processing speed, coupled with declining prices, have made PC's even more attractive. As chart 3 indicates, the price of PC's has dropped by more than forty fold since 1977, according to the computer price deflator computed by the Department of Commerce. This is one of the primary reasons that so many households have bought PC's for personal use. In the business sector, the movement away from expensive single computers to small interconnected PC's has been responsible for their popularity.

While the electronic computers industry segment (SIC 3571) is the most important category in computer manufacturing, storage devices, terminals, and other parts (SIC's 3572–9) also are significant. (See table 1.) These segments together employed 43 percent of workers in computer equipment manufacturing in 1994 and had nearly as large a share of the value of shipments.

Table 2. Distribution of market share by type of computer, 1979 and 1995

[In percent]

Computer type	Units		Value	
	1975	1995	1975	1995
Mainframe	15	1	76	29
Mini computer	61	2	23	25
Micro computer	24	97	1	46

NOTE: 1995 data are estimates.

SOURCE: Based on data from the *Computer Industry Almanac.*

Table 3. Price and speed of computers, selected years, 1975–95

Year	Device	Million instructions per second	Price	Price per million instructions per second
1975	IBM Mainframe	10	$10,000,000	$1,000,000
1976	Cray 1	160	20,000,000	125,000
1979	DEC VAX	1	200,000	200,000
1981	IBM PC	0.25	3,000	12,000
1984	Sun 2	1	10,000	10,000
1994	Intel Pentium	66	3,000	45

SOURCE: *PC Graphics & Video*, May 1995.

Technology's impact on cost

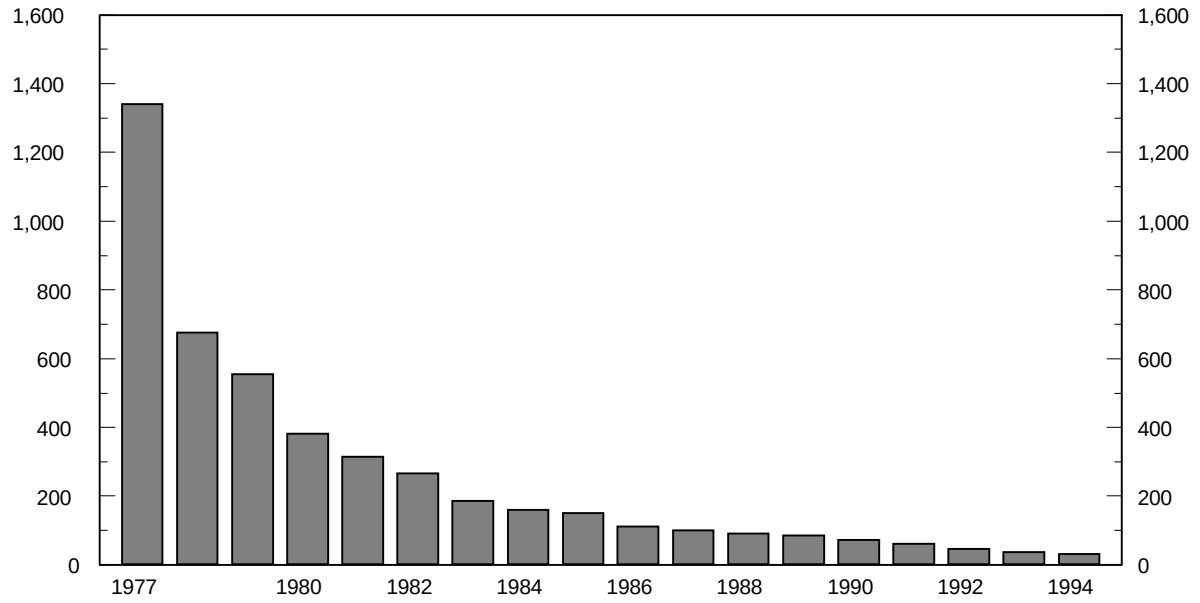
Increased sales in the computer industry have stemmed from the public's demand for affordably priced computers that are faster and more powerful so that users can retrieve and send data, play games, and run programs. Businesses have found that computers can save them money by automating many tasks and allowing owners to analyze and retain many crucial records. One of the most important advances is the speed at which computers are capable of processing data. This, paired with the rapid decline in the cost of obtaining this speed, is the reason more than 30 million U.S. households own personal computers. In 1975, the mainframe was capable of computing 10 million instructions per second at a cost of 10 million dollars. Today, the leading microprocessors can compute 66 million instructions per second at a cost of only $2,000 to $3,000.[12] That means the cost of computing one million instructions has dropped from $1 million in 1975, to about $45 in 1994.[13] (See table 3.) This incredible decrease in cost and increase in computing power can be credited to extraordinary advances in the manufacture of microprocessors which contain more than a thousand more transistors than was possible in 1971.[14]

The brisk increase in computing power is expected to continue for years to come, according to "Moore's law." Gordon Moore, co-inventor of the microprocessor, declared that raw computing power doubles every 18 months. At this pace, all the computing power that exists today in some of the costliest supercomputers may power children's toys in the future.

The extraordinary speed of today's computers is not the only important development. The rapid decrease in cost, spurred on by a fiercely competitive market also is critical. Lower prices of computers occur when new technology is introduced at lower prices, which pushes the prices of existing technology even lower. As each new technological breakthrough makes its way into the market, the previous "best product" becomes very affordable. One company enjoyed an edge in the market when they introduced the next generation in microprocessors. It was not long until competitors caught up and introduced similar microprocessors at lower prices. To stay competitive, manufacturers must quickly slash prices and start planning their next better, faster product. This constant pressure has led the computer industry to reduce prices while continuing to improve their products.

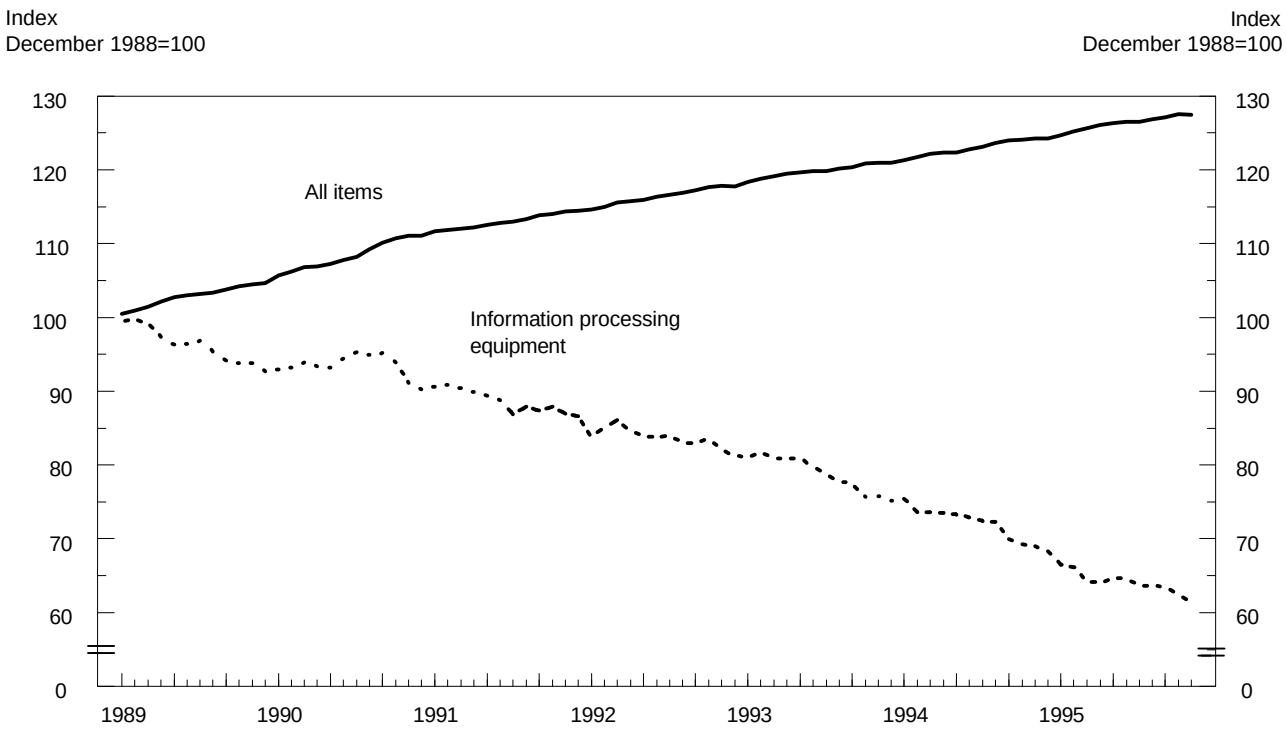
As a result of the price slashing, the CPI[15] for information processing equipment (primarily computers) has fallen considerably, compared with the CPI for all goods, which has risen steadily over time. (See chart 4.) This behavior is somewhat

Chart 3. **Personal computer price deflator, 1977–94**



SOURCE: Department of Commerce, Economic and Statistics Administration

Chart 4. **Consumer Price Index for information processing equipment and all items, 1989–95**



unique to the computer industry, and is the fuel behind the billions of dollars in shipments that the industry enjoys. The low prices also have had an impact on employment. Declining profit margins have forced computer manufacturers to produce more with less resources, possibly resulting in labor cutbacks.

Employment trends

There are many theories concerning the effect high technology has on employment. Some argue that technology reduces jobs, as machines take over what people used to do, while others claim that there is no effect. Still others claim that employment will increase as more highly skilled workers are needed, and as the definition of an acceptable product is constantly revised upward. It is difficult to quantify exactly what effect technology has had on the computer industry. Chart 5 shows total computer employment. Between 1960 and 1985, it would appear that technology had an upward effect on employment. Large job gains followed major technological breakthroughs. The United States dominated mainframe and PC markets worldwide and domestic employment in the computer industry increased significantly. There was especially rapid growth following the invention of the world's first PC. The computer industry enjoyed a growth rate of 85 percent from 1975 to 1984, while the rest of total nonfarm employment grew by 23 percent. During this period, growth accelerated after the introduction of personal computers. After reaching an all-time high in 1984, the industry began to shed jobs rapidly, with employment falling at an average annual rate of 3 percent. The reasons behind this quick downturn are shifting market dynamics brought about by technological change, streamlined production capabilities, and international competition.

Changing market structures. The market structure changed in the computer industry as the PC segment developed. To illustrate this point, consider IBM, which originally concentrated primarily on manufacturing mainframe computers for government and business. As technology advanced, the price of computing dropped and sales of mainframes decreased. Many businesses found that lower priced alternatives, such as fully programmed PC's and networked computers, suited their needs as well as mainframes. To help offset the decline in mainframe sales, large-scale vendors such as IBM were faced with "making drastic cuts in operating costs, and accelerating their migration to lower cost technology. Most reduced head count, trimmed [research and development], and formed technology partnerships with competitors."[16] From 1993 through 1995, IBM laid off 120,000 people.[17] In 1993, the top

Chart 5. **Employment in computers and office equipment, 1957–95**

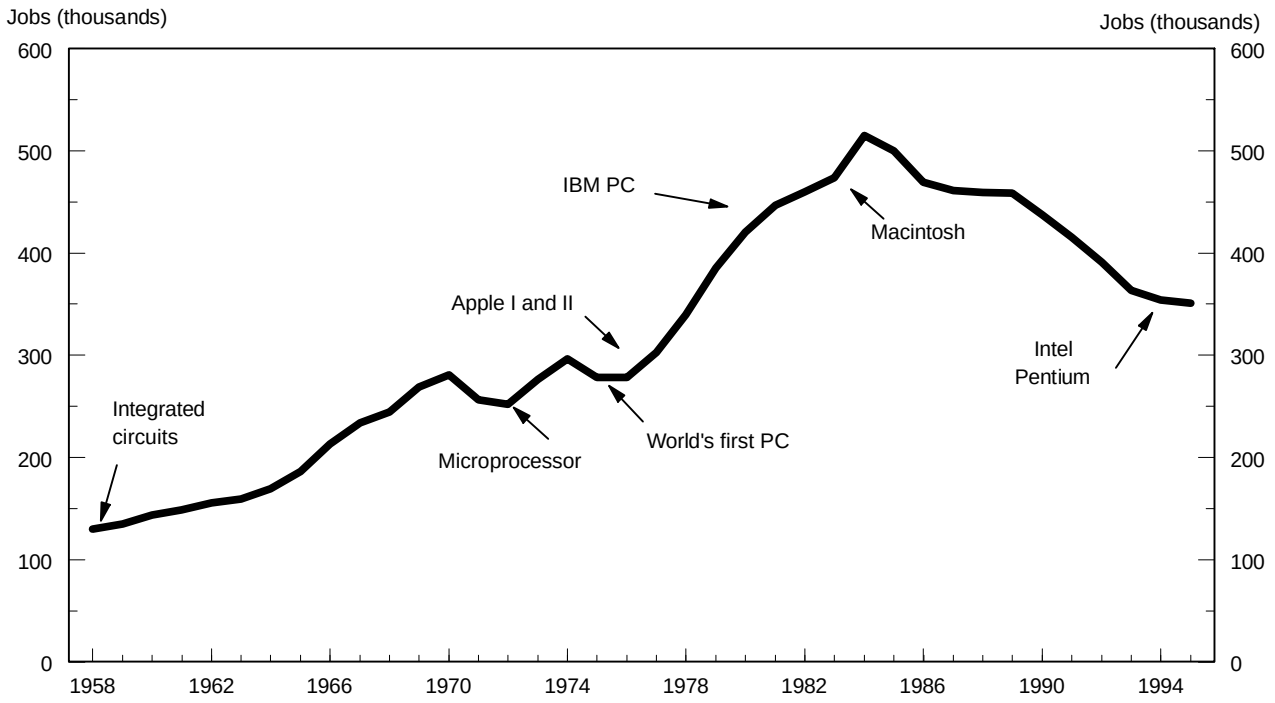
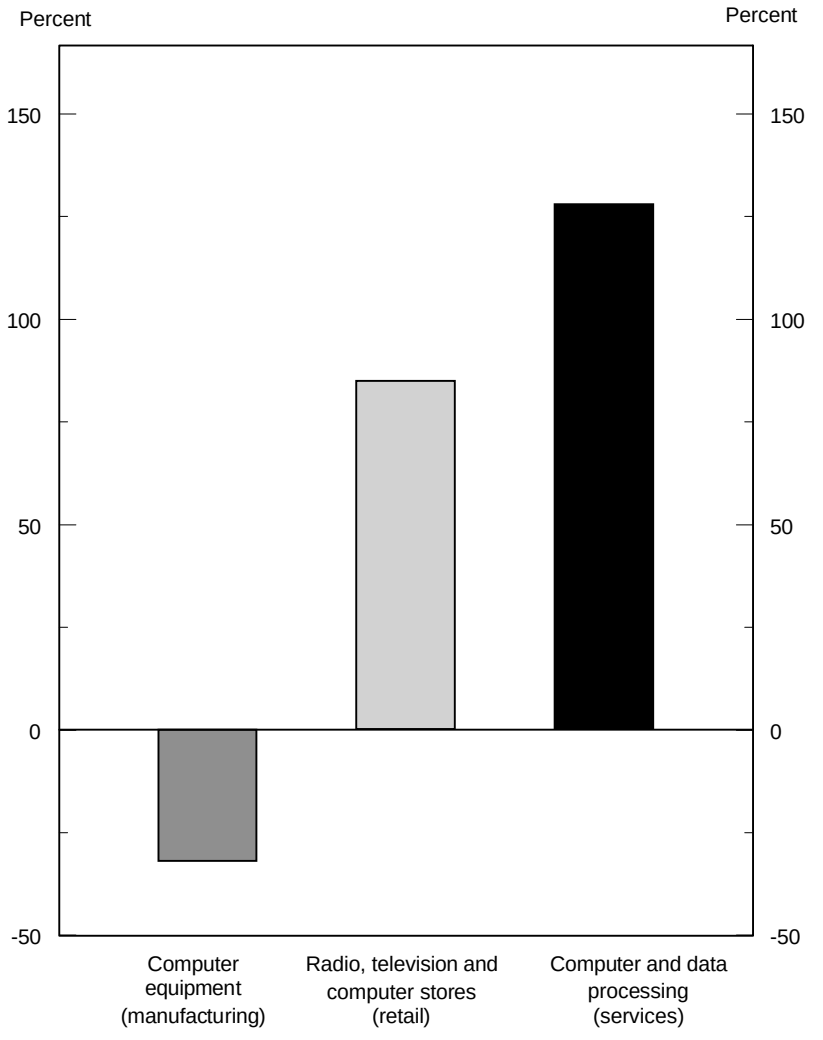


Chart 6. **Percent change in employment in computer-related industries, 1984–95**



three manufacturers of mainframe systems saw decreases in revenue of 16 to 47 percent.[18] To compensate for the lowered sales, and the increasingly cheap alternative technologies, many jobs were eliminated. Large numbers of these jobs were not transferred to PC production because this sector also discovered that they could produce more with fewer employees. In addition, many computer manufacturers moved some production facilities overseas to take advantage of lower labor costs. This cost-cutting behavior has been mirrored throughout the industry, partially explaining the large employment decline since 1984.

Another dramatic change in the market structure of computers that has had an impact on employment is the shift in importance from computer hardware to computer software and services. As the technologies of manufacturing computers becomes more routine and cheaply available, jobs are eliminated from computer manufacturing. On the other hand, industries that support computers have shown a remarkable increase in employment. Consider radio, television, and computer retail stores (SIC 573), for which employment has increased 85 percent since 1984, and computer and data processing services (SIC 737), with an employment increase of 128 percent. (See chart 6.) In contrast, computer manufacturing lost 32 percent of its work force during this same time. This evidence suggests that consumers are demanding increased service and software to support the computers they already have—a trend that is expected to increase.

Sales of computer software were more than $7.3 billion in 1994; an increase of 16.6 percent in just 1 year.[19] According to a poll conducted by *Discount Store News*, in terms of growth potential, computer software placed first out of 29 categories, while computer hardware placed fifth.[20] Many companies are finding larger profits through software and support sales, rather than hardware. For example, Barrister Information Systems Corporation reorganized by moving away from "low-margin computer hardware to focus on the more profitable computer software and service business."[21] Barrister's sales rose due to higher revenues from hardware maintenance contracts and services, rather than sales of the hardware itself. Employment data supports the premise that many companies are following suit. The shift away from focusing on computer hardware has caused a decrease in computer manufacturing employment, while the number of jobs related to software has continued to grow.[22]

Technology. Another factor explaining job losses since the mid–1980's is job replacement attributable to new technology in computer manufacturing. New manufacturing processes are constantly introduced that eliminate jobs. Computer manufacturers are "using their own products at every stage of the computer manufacturing process."[23] For example, computers were much larger than they are now, and contained thousands of wires and parts. Nowadays, "integration of components onto printed circuit boards, many layers thick, has often done away with the need to manually connect components together."[24] Consistent with this fact is the ratio of pro-

duction workers to all workers in computer equipment manufacturing. (See chart 7.) This ratio declined sharply between 1960 and 1990, as routine assembly jobs were mechanized. Currently, only about 35 percent of computer manufacturing workers are directly involved in production, as compared with 65 percent in 1960. In all manufacturing industries, about 70 percent of workers are directly involved in production.

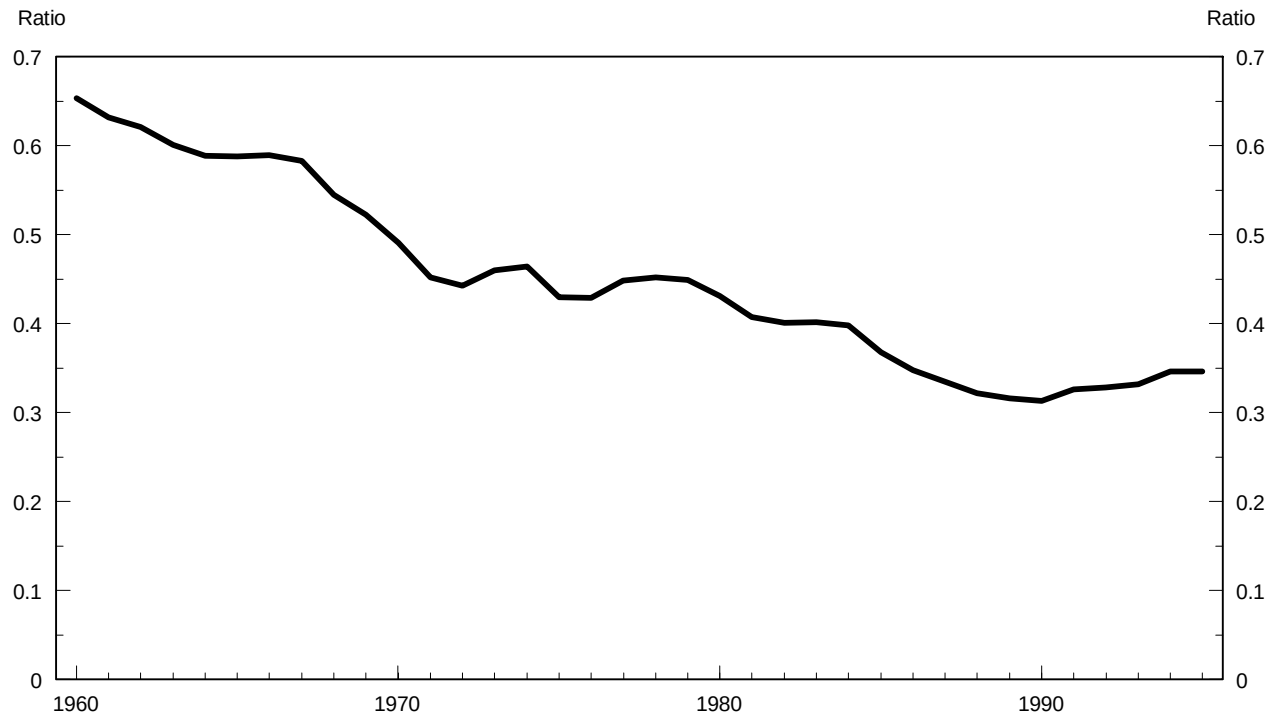
As a further indication of the impact of technology on employment in computer manufacturing, the labor cost of "a small computer—personal computer or workstation—is now typically less than 5 percent of the overall manufacturing cost."[25] The computer industry is the fifth largest spender on automation in the United States, and is the first in automation investment per production worker.[26]

International competition. Some of the employment decline in the computer industry is attributable to international competition. Once the world leader in computer equipment manufacturing, the United States has maintained a trade deficit in this product since 1992. (See chart 8.) This decline is due to imports increasing at a more rapid rate than exports. Between 1989 and 1993, exports grew by 5.8 percent, while imports grew by 15.6 percent.[27]

Computer parts and peripherals are particularly sensitive to demand for exports; the U.S. Department of Commerce estimates that more than half of the labor force in this industry is engaged in jobs related to exports.[28] Sales to foreign countries are vital to the entire computer industry's growth, and should they weaken, so too may employment. In fact, "foreign operations now account for more than half of the total revenues of many leading U.S. suppliers, and some report foreign sales amounting to 70 percent of their total business or more."[29] The only major computer market that the United States does not dominate is Japan, where local companies control 70 percent of the market.[30] In other foreign markets, governments "continue to pursue restrictive trade and investment policies that adversely affect U.S. exports by limiting imports" and by supporting domestic computer industries through " 'buy national' procurement policies, low-interest financing, and export subsidies."[31] Thus, the health of the U.S. computer industry is particularly vulnerable to worldwide competition and economic cycles experienced by our major trading partners.

The share of computer equipment purchased in the United States that is imported has risen from 42 percent in 1989 to an estimated 65 percent in 1995. Part of these imports are from U.S. computer companies that have opted to move production facilities overseas to take advantage of the lower labor rates, as well as expand into local markets. Scotland's Silicon Glen has seen employment at American-owned computer

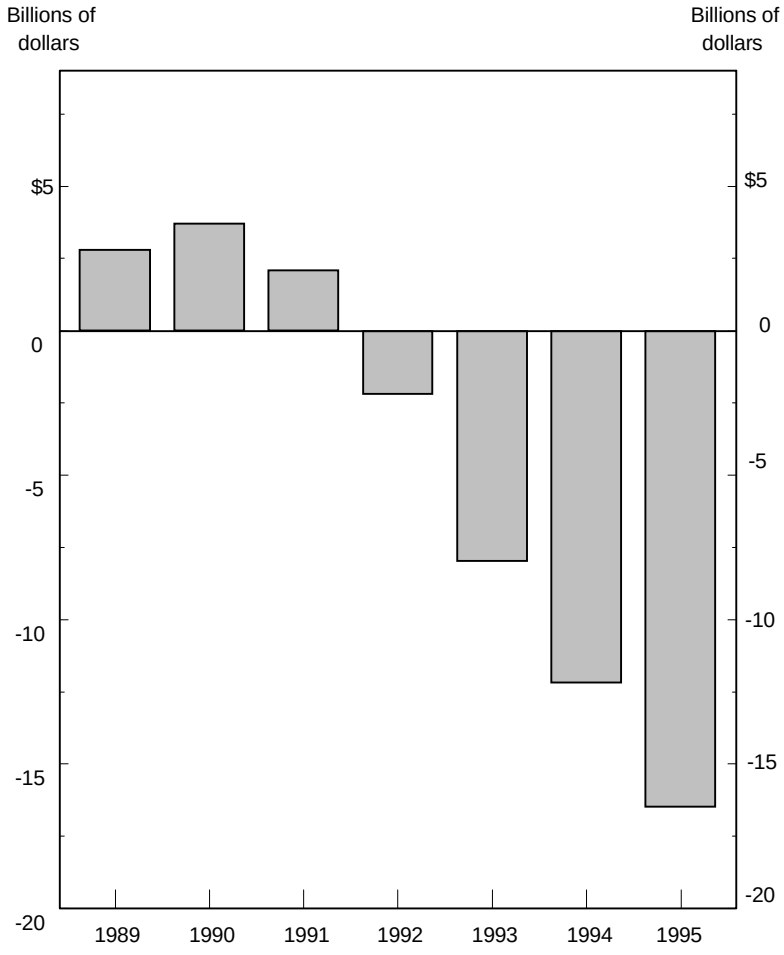
Chart 7. **Ratio of production workers to all employees in computer equipment manufacturing 1960–95**



manufacturing plants grow by 41 percent. In fact, 10 percent of the world's personal computers are produced there. IBM has built the world's largest personal computer manufacturing plant in Silicon Glen, with about 1.3 million computers produced in 1993.[32] "The IBM plant, which employs more than 2,500 people, has reduced the lead time required to bring a new product to market to between 6 and 9 months, while output volume jumped 20 percent last year—double the industry average."[33] Scotland is one of many overseas locations where U.S. computer manufacturers are building new production facilities. While this may help keep the industry healthy, it does not increase domestic employment. In fact, this expansion abroad occurred at the same time that employment was declining in the United States, and partially explains the employment declines seen in recent years.

A growing portion of computer parts and peripherals are imported from foreign-owned firms. As these foreign companies adopt leading edge technologies, their products become increasingly in demand. Asian-origin parts and peripherals "represented more than 80 percent of total imports" in 1994.[34] While some of these imports may be attributed to U.S. firms operating in Asia, a large share are from Asian-owned firms. In fact, most computers assembled and sold in the United States contain disk drives from Singapore, monitors from South Korea, and motherboards from Taiwan. The composition of these computers reflects the continuing globalization of the computer manufacturing industry.

Chart 8. **United States trade balance in electronic computing equipment, 1989–95**



SOURCE: Bureau of the Census.

NOTE: 1995 figures are estimates by the Department of Commerce.

Recent trends

The good news for employment in computer manufacturing is that technology also can increase the need for certain types of workers. An example is IBM's new breed of mainframe. IBM has recently responded to customers' desire for more affordable large-scale computing power by introducing a mainframe geared toward their needs. It has more of the features that businesses have been demanding, at lower prices. In addition, the company has increased its focus on software to sustain their product, as well as the technical support that customers have demanded. Responding to these new market trends, the company has halted employment cuts in many of its departments, and increased the need for workers in others.[35] In fact, this restructuring is mirrored by employment estimates of computer manufacturing. (See chart 9.) Much of the newer technological processes require a higher degree of knowledge; employees possessing such credentials, especially in computer manufacturing, will be in high demand. Skilled professionals, "engineers—anyone who carries around a lot of technical knowledge and expertise—can probably choose among multiple job offers these days."[36] So while technology may cause some jobs to be lost, the development of new products can reverse the trend, if only temporarily.

Research and development

The computer industry spends billions of its own dollars each year on research and development, and billions more come

Chart 9. **Employment in computer and office equipment, seasonally adjusted, 1994–96**

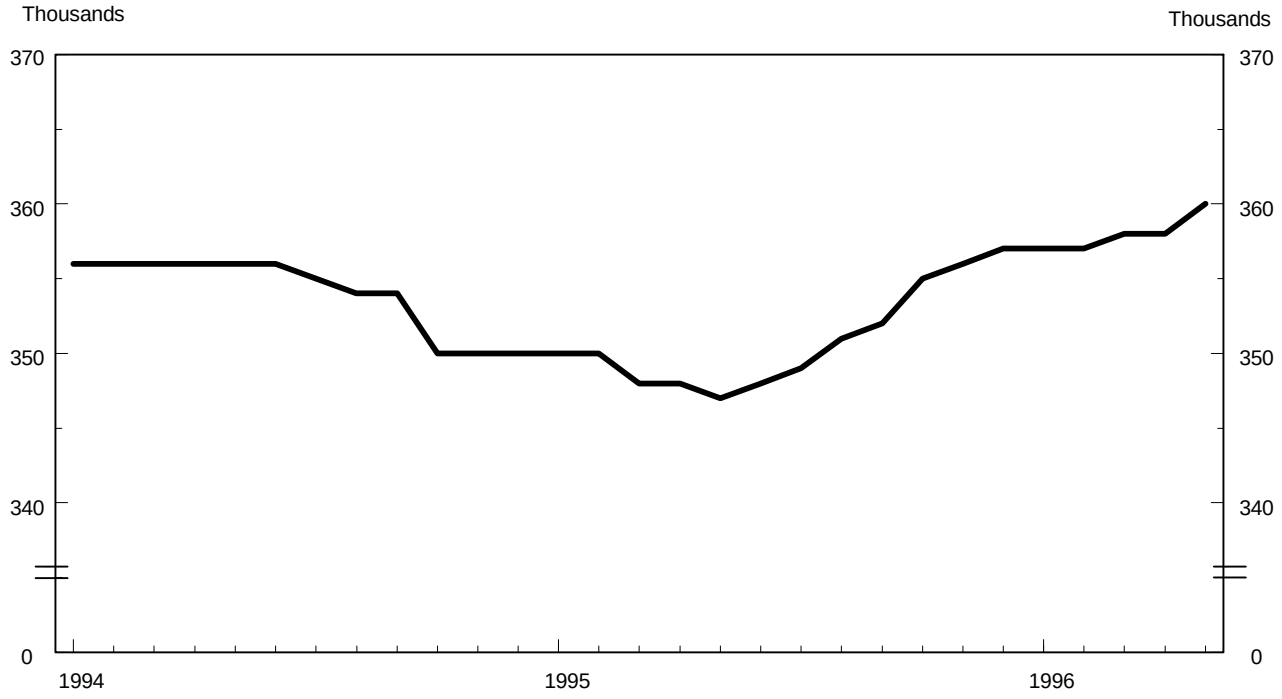
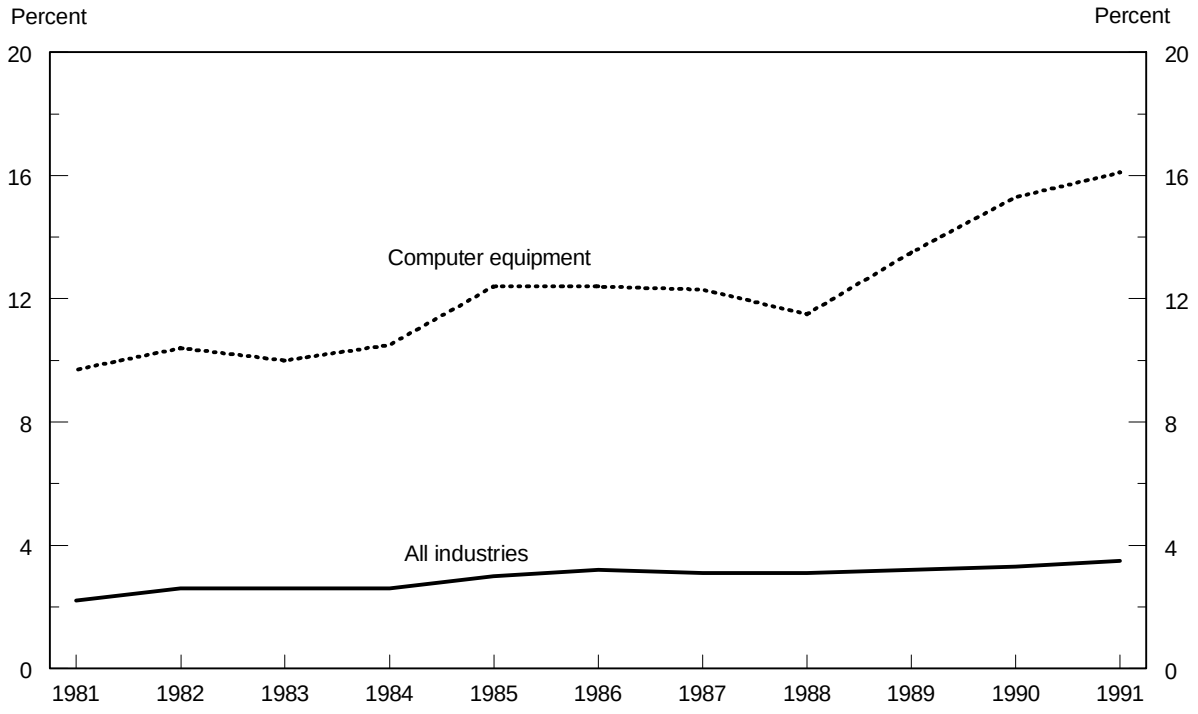


Chart 10. **Company funds spent on research and development as a percent of net sales, 1981–91**



SOURCE: National Science Foundation.
NOTE: Base is all companies that spend at least $1 million annually on research and development.

from the Federal Government. Computer companies accounted for 13 percent of all funds spent on research and development in 1991.[37] In a comparison of companies with research and development activities, the computer industry spent more on research and development as a percentage (16.1 percent) of net sales than any other industry. (See chart 10.) This is up from 9.7 percent in 1981, the year IBM introduced the PC. The Federal Government spent 4 percent of Federal research and development funds on contracts with computer companies in 1991. The amount of Federal funds spent on computer research and development has increased by 52 percent from 1981 through 1991, but in real dollars, it has remained virtually unchanged.

Computer industry experts agree that the impact of research and development on employment, with all the billions of dollars spent, is unclear. While there usually are a relatively small number of jobs funded in the short term, "[Research and development] spending often accompanies respectable gains in sales, market share, and market value a few years down the road."[38] As new and cheaper ways to manufacture existing or better products are developed, production workers might find their jobs mechanized or streamlined. However, as demand grows for the cheaper product, more employees may be needed to fill increased orders.

Employment outlook

As one of the most important industries of the information age, computers have had an enormous impact on society. The number of jobs directly supplied to the economy is not great, but what those workers produce provides tremendous technological possibilities and opportunities throughout the economy. The Bureau of Labor Statistics projects that employment in computer equipment manufacturing will drop by 25 percent between 1994–2005.[39] Many large companies that manufacture computer equipment already have shifted their focus to produce the support needed to maintain the computer equipment and the software to maximize its utility. Technological innovations have enabled computer manufacturers to deliver more for less. The future of computer manufacturing is positive in that the ever growing need for information technology will demand better, faster computers. It is negative, however, for computer manufacturing employees because in order to stay competitive and keep up with market demands, manufacturers must produce more with fewer workers. As we enter the second millennium, computers are likely to have a growing impact on our every day lives, and the companies that manufacture them are expected to provide a declining number of jobs in the U.S. economy. □

Footnotes

[1] John Huey, "Waking up to the new economy," *Fortune*, June 27, 1994.

[2] Engil Juliussen and Karen Petska-Juliussen, *Computer Industry Almanac; 1994–1995*, (Austin, TX, The Reference Press, Inc., 1994) p. 2.

[3] Employment data used in this article are from the Bureau of Labor Statistics Current Employment Statistics (CES) program, a monthly survey of the number of employees on nonfarm payrolls, their earnings, and the hours they worked. This data is presented in the Bureau's publication *Employment and Earnings*.

[4] Tom Masloski, "Accounting methods altered in mid-19th century," *Crains Chicago Business*, June 23, 1986, p. T6.

[5] Todd Olsen, "From dots and dashes to digital; telecommunications technology," *Scholastic Update*, Sept. 2, 1994, p. 16.

[6] The Standard Industrial Classification (SIC) is the statistical classification standard underlying all Federal establishment-based data. For more information, see *Standard Industrial Classification Manual, 1987* (Washington, DC, Office of Management and Budget).

[7] U.S. Department of Commerce, Bureau of the Census, 1994 Annual Survey of Manufacturers.

[8] Ibid.

[9] Randall L. Tobias, "Telecommunications in the 1990's," *Business Horizons*, January 1990, p. 81.

[10] U.S. Department of Commerce, Bureau of the Census.

[11] The following section on major computer types was obtained from Juliussen and others, *Computer Industry Almanac*, p. 317.

[12] Tom Adams, "Processing Power," *PC Graphics & Video*, May 1995, p. 24.

[13] Adams, *PC Graphics & Video.*

[14] For more information on the semiconductor industry, see Francisco A. Moris, "Semiconductors: the building blocks of the information revolution," pp. 6–17 in this issue.

[15] Bureau of Labor Statistics, Consumer Price Index. The "All Items index" was recalculated on basis of 1988=100 for purposes of comparison.

[16] Jeff Moad, "Mainframe vendors hard hit," *Datamation*, June 15, 1994, p. 49.

[17] Martin Walker, "Dumbsizers take the shirt off your back," *The Observer*, May 19, 1996, p. 6.

[18] Moad, *Datamation.*

[19] *Electronic Market Data Book (*Electronic Industries Association, 1995), p. 62.

[20] "Electronics set to explode in mass market; consumer electronics sales," *Discount Store News*, Oct. 2, 1995, p. 21.

[21] David Robinson, "Barrister ekes out a $4,000 profit," *The Buffalo News*, Aug. 4, 1995, p. 7b.

[22] For more information about computer software, see Laura A. Freeman, "Job creation and the emerging home computer market," pp. 46–56 in this issue; and for computer services, see William Goodman, "The software and engineering industries: threatened by technological change?" pp. 37–45 in this issue.

[23] Alan Cane, "Survey of Computers in Manufacturing" *Financial Times*, Sept. 24, 1992.

[24] Ibid.

[25] Ibid.

[26] *U.S. Industrial Outlook* (U.S. Department of Commerce, International Trade Administration, January 1994)

[27] *U.S. Global Trade Outlook: 1995–2000: Toward The 21st Century* (U.S. Department of Commerce, International Trade Administration, March 1995),

p. 120.

[28] Ibid., p. 123.

[29] Ibid.

[30] Ibid.

[31] Ibid.

[32] "North American Companies Explain Why Scotland is an Excellent Manufacturing Location," *PR Newswire*, Nov. 1, 1994.

[33] Ibid.

[34] *U.S. Global Trade Outlook*, p. 124.

[35] Ira Sager and Amy Cortese, "At IBM, the great shrink-down may be over," *Business Week*, Sept. 25, 1995, p. 58.

[36] James Aley, "Where the jobs are," *Fortune*, Sept. 18, 1995, p. 53.

[37] This and the following data on research and development funds are from *Research and Development in Industry: 1991* Bulletin NSF 94–325 (Washington, DC, National Science Foundation Jan. 1992). Base is all companies that spend $1 million annually on research and development.

[38] Gary H. Anthes and Mitch Betts, "R&D: Measure of success," *Computerworld*, Nov. 14, 1994, p. 32.

[39] Bureau of Labor Statistics, Office of Employment Projections.

"Fax-on-demand" available

Users of data from the Bureau of Labor Statistics can request a fax of news releases, historical data, and technical information 24 hours a day, 7 days a week from FAXSTAT, the Bureau's new fax-on-demand system.

FAXSTAT users can receive news releases of major economic indicators (see schedule on back cover of this issue) beginning at 8:45 a.m. on the morning the data are released. The number to obtain data from the national office is:

(202) 606–6325

Use a touch-tone telephone and follow the voice instructions for entering document codes and your fax telephone number. The FAXSTAT catalog, containing a list of available documents and codes, can be obtained by entering code 1000. You may request up to four documents with each call. Faxes are sent immediately following the request. If your fax line is busy, the system attempts to send the requested material four times before disconnecting.

FAXSTAT numbers for BLS regions are listed on cover 2.